Introduction - Scalar Fields

- ▶ Scalar fields are visualized by heat maps (color codings) classically

- ▶ Each position in space is mapped a scalar height value

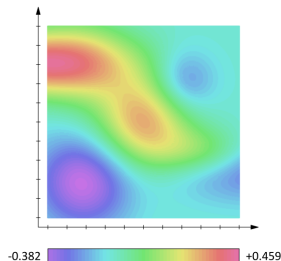- ▶ Examples: temperature field, height field

Figure: Scalar field, *Source:* ①

Introduction - Vector Fields

▶ Vector fields are visualized by a collection of arrows with a given magnitude and direction classically

▶ Each position in space is mapped a scalar magnitude and an angle

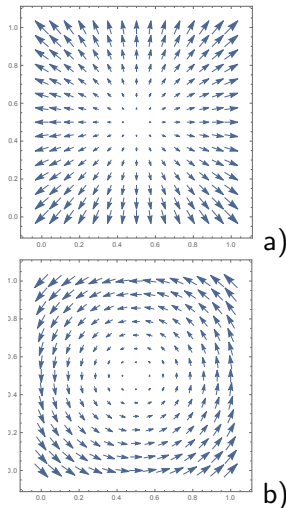▶ Examples: flow field, magnetic field, gravitational field

Figure: Vector fields: a) $\{x, y\}$, b) $\{-y, x\}$

Introduction - Tensor Fields

▶ Tensor fields are commonly
  visualized by:
  ▶ Glyphs
  ▶ Tensor field lines (TFLs)
    ⇒ Hyperstreamlines

▶ Each position in space is
  mapped a tensor describing
  a directional distribution

▶ Scalar Measures: anisotropy
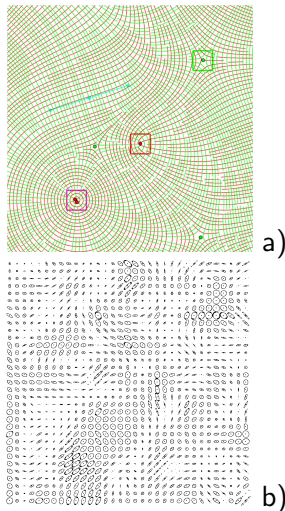 index, tensor magnitude

Figure: Tensor fields: a) Tensor field
lines, b) Glyphs

Motivation - Tensor Fields

Applications:

- ▶ Vector fields: to describe the directionally dependent spatial gradient called Jacobian-matrix,
- ▶ Fluid and solid continuum mechanics: to describe a whole distribution of stresses
- ▶ DT-MRI: diffusion tensor - magnetic resonance imaging: to describe the diffusion characteristics of water molecules within tissue